

Sustainable Schools



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The Current State of Our Schools

- “Public school buildings are in a serious state of disrepair due to past design approaches or deferred maintenance.”
 - General Accounting Office
- Cost of bringing America’s schools up to contemporary standards is estimated at more than \$260 billion
- Half of all school facilities have indoor environmental problems that have negative impacts on the daily performance of students and teachers

Trends in School Construction

- More school construction completed in 2002 than any year in U.S. history
 - Projects estimated at \$26 billion
- In 2002, there was the first large increase in the percentage of money being spent on new school construction instead of renovation – this percentage is expected to continue to rise
- Constraints to sustainable school design include institutional and community issues, legal and regulatory issues, and specific project issues

School Design and Architecture

- Theories about the design and architecture of schools and classrooms have been debated for centuries
 - Views of the outdoors/Window size
 - Size and shape of classroom
 - Modular construction
- Challenge is to integrate sustainable design into these theories
- High Performance Schools Act of 1999

Sustainable Schools

- U.S. Dept. of Education Design Principles: Schools as Center of Community
 - Enhance teaching and learning and accommodate the needs of learners.
 - Serve as center of the community.
 - Result from a planning/design process involving all stakeholders.
 - Provide for health, safety and security.
 - Make effective use of all available resources.
- Eco-Educational features
- Benefits to students' – improved learning environment
- U.S. Dept. of Energy estimates that schools could save \$1.5 billion annually by “greening” themselves

Case Study: Walker Elementary

- Roy Lee Walker Elementary School in McKinney, TX (McKinney Independent School District)
- Completed July 2000
- Opened for school August 2000
- Partnerships with State Energy Conservation Office (SECO) and a diverse design team



Sustainable Building Features

- State of Texas Eight Step Sustainable Building Program (SECO)
 - Siting
 - Material
 - Energy
 - Water
 - Waste
 - Indoor Air Quality
 - Pest Management
 - Building Maintenance
- McKinney ISD also included other decisions concerning transportation and construction
- Educational features also received consideration

<u>SUSTAINABLE FEATURES DESIGNED/BID</u>		
	Incorporated	
	Yes	No
Siting	X	
Daylighting	X	
Geothermal Heat Pumps		X
Energy Mgmt Controls	X	
Solar Energy-Domestic Hot Water	X	
PV Electrical Power		X
Radiant Barrier	X	
Rainwater Collection System	X	
Energy Recovery System	X	
ECO Education Modules	X	
Weather Station	X	
Environmental Material Selected	X	
Recycled Steel	X	
Recyclable Carpet	X	
Rainwater for Toilet Flushing		X
Rainwater for Irrigation	X	
Windmill	X	
Natural Landscaping	X	
Recycling	X	
Transportation	X	
Efficient Lighting	X	
New Sustainable Light Fixture	X	
Lighting Controls	X	
Dimmable Fluorescent Ballasts	X	
Efficient Envelope	X	
Greenhouse	X	

Figure 2. Sustainable Features Designed/Bid

<u>OTHER SUSTAINABLE FEATURES CONSIDERED BUT NOT DESIGNED/BID</u>
Waterless Urinals
Solar Absorption Air-Conditioning System
Zero VOC Paint

Figure 3. Sustainable Features Considered but Not Designed/Bid

Life-Cycle Costs

Life Cycle Stages

Material Resources
and
Raw Materials

- Limited or rare resource?
- Environmental impact?
- Location of Materials?
- Transportation?
- Other?

Manufacturing,
Fabrication,
and Assembly

- Location?
- Energy efficient plant & processes?
- Hazardous materials eliminated from process?
- Recyclability of waste?
- Transportation?
- Other?

Construction,
Use, and
Maintenance

- Waste Recycling?
- Energy efficient?
- IAQ?
- Environmental impact?
- Hazardous materials waste?
- Flexible building & systems?
- Maintainable? Durable?
- Other?

Recycling
or
Demolition

- Toxic or hazardous?
- Materials separable for recycling?
- Recyclable for other uses?
- Impact of waste disposal?

Life-Cycle Costs:

Product Information Requests

- Are hazardous by-products produced?
- What is the amount of energy required in the process?
- What basic raw materials are used in the product? (% by weight)
- What is the environmental impact of extracting the raw materials?
- Is recycling and reclaiming of waste used at the manufacturing plant?
- Are any EPA targeted chemicals used in the process?
- Is the manufacturing plant energy efficient?
- Will the end product have any outgassing materials?
- What is the energy efficiency of the end product?
- How will the product be shipped from the manufacturing plant to McKinney, Texas?
- Does the product have any certifications, such as Green Seal, etc.?

Eco-Education Features

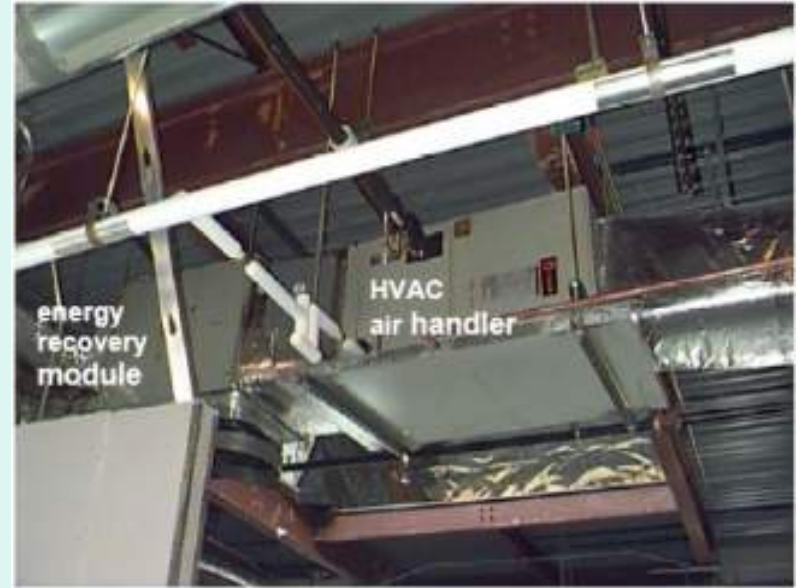


- Sun dial
- Visible rainwater collection system
- Active solar energy collectors
- Daylighting
- Greenhouses
- Eco-Pond
- Campus Weather Station
- Interactive computer module with Eco-modules, building systems instrumentation for display, dynamic graphics, etc.



Evaluation

- Unable to find current data regarding energy savings, emissions, etc.
- Cost difference?
Premium?
- Current research being conducted by SECO to compare Walker and another nearby elementary school
- Problems
 - Did not use zero-VOC paints



"To build or rebuild our schools without rethinking the experiences that take place within them seems as unwise as revamping teaching and learning without considering new designs for learning environments. Together, these trends create an opportunity to redesign both schools and schooling."

-Daniel L. Duke, Thomas Jefferson Center for Educational Design at the University of Virginia

" It is not our goal to be a green building. It is not our goal to be an energy efficient building. Our goal is to be an educational facility and be the best educational facility we can be. Green buildings, energy-efficient buildings are strategies to reach that goal."

-Bill Dierdorff, North Clackamas School District



References

- Weiss, Jonathan. *Issuetrak Briefing on Sustainable Schools*. Council for Educational Facilities Planners International (CEFPI), 2000. <http://www.cefpi.org/pdf/issue11.pdf> 3/28/2004.
- School Planning and Management. *2003 Construction Report*. <http://www.rebuild.org/attachments/SolutionCenter/SPMConstruction2003.pdf> 3/28/2004.
- Tremain, K. "Little Green Schoolhouse: Why Not Build Schools that Are Better for Kids and the Environment?" *The New Democrat*, Sept/Oct 1999, pp. 17-19.
- Loisos, G. *Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance*(1999); Hescong Mahone Group for Pacific Gas and Power Co., Fair Oaks, California; <http://h-m-g.com> 3/28/2004.
- United States Department of Education. "Design Principles for Planning Schools as Centers of Communities." Posted by National Clearinghouse for Educational Facilities. http://www.edfacilities.org/rl/community_use.cfm 3/28/2004.
- McClure, James D., et al. *Sustainable Features of McKinney ISD Elementary School*. <http://www.estesmcclure.com/research/mckinney.pdf> 3/29/2004.
- Walker Elementary Homepage <http://www.mckinneyisd.net/walker/> 3/29/2004.
- Brubaker, William C. *Planning and Designing Schools*. McGraw-Hill: 1997.
- Dudek, Mark. *Architecture of Schools: The New Learning Environments*. Architectural Press, London: 2000.
- Sustainability Education Handbook <http://www.urbanoptions.org/SustainEdHandbook/Introduction.htm> 3/29/2004.
- National Clearinghouse for Educational Facilities <http://www.edfacilities.org> 3/29/2004.
- Sustainable Design For Schools <http://www.pprc.org/pprc/pubs/topics/schools/apply.html> 3/29/2004.
- Energy Smart Schools Program www.energysmartschools.gov 3/29/2004.